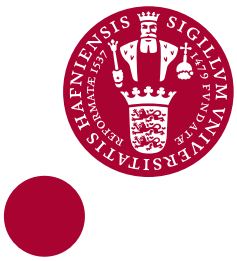

Ultrasound Examination Through The Sole Horn On A WeightBearing Claw: Pilot In Vitro Study

Bach, Kurt; Nielsen, Søren Saxmose; Capion, Nynne

Ultrasound examination through the sole horn on a weight-bearing claw: pilot in-vitro study

Author: Bach K[1], Nielsen SS[1], Capion N[1]

[1]Faculty of Health and Medical Sciences - University of Copenhagen

kurtbach@sund.ku.dk

Introduction

A decrease of the soft tissue thickness in the claw increases the pressure on the corium from the pedal bone and may lead to injuries and claw horn lesions (Ossent & Lischer 1998, Tarlton, et al. 2002). Ultrasonography has been described as a useful method to exam the soft tissue inside the claw capsule (Kofler, et al. 1999, Laven, et al. 2012, Toholj, et al. 2013, van Amstel, et al. 2004), but performing ultrasonography directly through the sole horn on raised claws or on legs of slaughtered cattle. The aim of this study was to develop a method that made it possible to measure the thickness of the soft tissue inside the bovine claw using ultrasonography on a weight-bearing leg of live cattle.

Materials and methods

We designed a tub made of polyethylene with the following dimensions: width: 750 mm; length: 400 mm; height: 50 mm; thickness of the bottom: 10 mm (RIAS, Roskilde, Denmark). We checked if the tub was able to carry the weight of a cow.

Fifty-two hind feet from Holstein cows were collected from a slaughterhouse. After trimming the claws the sole of each claw underwent an ultrasonographic examination at two points as descripted by Laven et al. (2012). Examination was done with a linear-transducer from GE (GE i739L-RS) at 6 MHz connected to GE Loqic e (GE Healthcare, USA) portable scanner. Afterwards the examinations were repeated on the same claws, while the claws were placed in water with the sole horn in the bottom of the custom made polyethylene tub. The ultrasonografic examination was made from below through the bottom of the tub.

After scanning we measured the distance between the internal margin of the sole horn and the pedal bone by using the measuring software on the ultrasonographical machine.

Results

The 10 mm. polyethylene could carry the weight from the hindlegs of a 700 kg heavy Holstein cow

The correlation between the thickness of the soft tissue measured with the two different methods was 0.91 (Pearson's correlation coefficient, Figure 1).

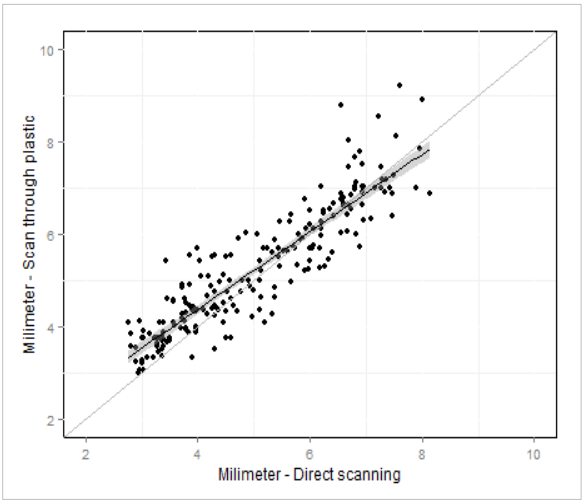

Figure 1: The correlation between the thickness of the soft tissue in millimeter, measured on ultrasonographic images from scannings made directly through the sole horn (x-axis) and scannings made through 10 mm. polyethylen and the sole horn (y-axis). The grey line represents a 100% correlation and the black line shows the correlation between the two methods.

Discussion

The bottom of the tub could carry the weight of a 700 kg cow. It was possible to scan through the

sole horn and a plastic plate, even though the image quality was not as good as from scans made directly through the sole horn, it was still possible to identify the essential structures: outside and inside margin of the sole horn and the pedal bone. The measurements made on sonographic images preformed directly through the sole horn and through the polyethylene plate respectively had an acceptable correlation.

Acknowledgements

Thanks to Mogens Nielsen Kreaturslagteri A/S for providing slaughter house legs.

References

Kofler J, Kubber P, and Henninger W 1999 Ultrasonographic imaging and thickness measurement of the sole horn and the underlying soft tissue layer in bovine claws. *Veterinary Journal* 157**:** 322-331.

Laven LJ, Laven RA, Parkinson TJ, Lopez-Villalobos N, and Margerison JK 2012 An evaluation of the changes in distance from the external sole surface to the distal phalanx in heifers in their first lactation. *Veterinary Journal* 193**:** 639-643.

Laven LJ, Margerison JK, and Laven RA 2012 Validation of a portable ultrasound machine for estimating sole thickness in dairy cattle in New Zealand. *New Zealand veterinary journal* 60**:** 123-128.

Ossent P, and Lischer C 1998 Bovine laminitis: the lesions and their pathogenesis. *In Practice* 20**:** 415-427.

Tarlton JF, Holah DE, Evans KM, Jones S, Pearson GR, and Webster AJF 2002 Biomechanical and Histopathological Changes in the Support Structures of Bovine Hooves around the Time of First Calving. *The Veterinary Journal* 163**:** 196-204.

Toholj B, Cincovic M, Stevancevic M, Spasojevic J, Ivetic V, and Potkonjak A 2013 Evaluation of ultrasonography for measuring solar soft tissue thickness as a predictor of sole ulcer formation in Holstein-Friesian dairy cows. *The Veterinary Journal* 199**:** 290-294.

van Amstel SR, Palin FL, and Shearer JK 2004 Measurement of the thickness of the corium and subcutaneous tissue of the hind claws of dairy cattle by ultrasound. *The Veterinary Record* 155**:** 630-633.

Keywords: Ultrasound, Weight bearing claw, Claw suspensory apparatus